

POLYCHAETA FROM DEEP-SEA HYDROTHERMAL
VENTS IN THE EASTERN PACIFIC. III.
A NEW GENUS AND TWO NEW SPECIES OF
SPIONIDAE FROM THE GUAYMAS BASIN AND
JUAN DE FUCA RIDGE WITH COMMENTS ON A
RELATED SPECIES FROM THE WESTERN
NORTH ATLANTIC

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Abstract.—Two new species of Spionidae were found in soft sediments at the Guaymas Basin and Juan de Fuca Ridge hydrothermal vent fields. These new spionids are unusual in having modified notopodial spines in anterior setigers and for possessing ventral as well as dorsal branchiae. Ventral branchiae have not been previously reported for the family. The presence of modified neuropodial spines in anterior setigers allies these species with the shallow water genus *Scolecopides*, however, a new genus, *Lindaspio*, is established because branchiae begin on setiger 2 instead of 1. The two new species, *L. dibranchiata* and *L. southwardorum*, are large, with the latter species from the Juan de Fuca Ridge, being one of the largest spionids ever reported. A previously described species, *S. carunculatus*, from ambient sediments on the continental slope off North Carolina has been reexamined and referred to the new genus *Lindaspio*. All three species are described and compared.

Approximately 63 polychaete species have been reported as occurring in the vicinity of active hydrothermal vents in the eastern Pacific (summarized by Blake & Hilbig 1990). At least another 25-30 species remain to be described from material already collected.

Three species of Spionidae including two genera, *Lauberiellus* and *Xandaros*, were described from the Galapagos Rift hydrothermal vents by Maciolek (1981). *Xandaros* appears to be restricted to vent habitats. The third species, *Prionospio sandersi*, was associated with the vestimentiferan *Riftia pachyptila*. No additional spionids have been described from vent ecosystems, although Blake & Hilbig (1990) reported a single specimen of an unidentified species of *Prionospio* from the Juan de Fuca Ridge. Recent expeditions to hydro-

thermal vent areas in the Guaymas Basin and Gorda Ridge by J. F. Grassle, and the Juan de Fuca Ridge by Verena Tunnicliffe and her associates have yielded additional spionids.

The present paper describes a new genus of Spionidae that was first collected by J. F. Grassle from sediments associated with hydrothermal mounds in the Guaymas Basin. This new spionid is unusual in possessing anterior notopodial spines and ventral branchiae. A second species was collected by Eve Southward, Alan J. Southward, and Verena Tunnicliffe from sediments near hydrothermal vents on the Juan de Fuca Ridge. These two species are referred to a new genus, *Lindaspio*, that has branchiae from setiger 2 and modified anterior neurosetae. A continental slope species from off North Carolina, *Scolecopides caruncula-*

tus Maciolek, has been reexamined and is also referred to this new genus.

The collections are deposited in the National Museum of Natural History, Smithsonian Institution (USNM), Washington, D.C.

Systematic Account

Family Spionidae

Lindaspio, new genus

Type species.—*Lindaspio dibranchiata*, new species. Gender feminine.

Diagnosis.—Prostomium incised, developed into 2 frontal lobes or weak horns; caruncle short; occipital tentacle lacking. Peristomium lacking lateral wings. Dorsal branchiae from setiger 2, ventral branchiae from an anterior segment, or ventral branchiae completely absent; branchiae closely associated with parapodial lamellae, continuing to posterior end. Setiger 1 reduced, with notopodia reduced to single lamella lacking notosetae; notopodia and neuropodia with capillaries and hooded hooks; some anterior notopodia with rosettes or clusters of heavy pointed spines, or spines absent; anterior neuropodia with fascicles of heavy spines. Genital pouches lacking. Pygidium simple, conical, lacking cirri.

Etymology.—The genus, *Lindaspio*, is named in memory of Linda Morse-Porteous, deep-sea biologist of the Woods Hole Oceanographic Institution, a colleague and friend who left us too soon.

Remarks.—*Lindaspio* is closely related to species belonging to the nearshore genus, *Scolecopides* as revised by Maciolek (1984). Both genera have anterior setigers with modified neuropodial spines and anteriorly bifurcated prostomia, sometimes expanded into frontal horns. *Lindaspio*, however, has branchiae beginning from setiger 2 instead of setiger 1. Further, the three species assigned to *Lindaspio* are from deep-sea habitats, where species of *Scolecopides* are only known from nearshore estuarine habitats.

Three species are assigned to this genus:

Lindaspio dibranchiata, new species

L. southwardorum, new species

L. carunculata (Maciolek, 1984),
new combination

Lindaspio dibranchiata, new species

Figs. 1, 2

Material examined.—Guaymas Basin, Southern Trough, hydrothermal mounds, *Alvin* Dive 1606, box core No. 1, 28 Jul 1985, 27°01'N, 111°24'W, 2008 m, paratype (USNM 148672); *Alvin* Dive 1614, box core No. 3, 6 Aug 1985, 27°01'N, 111°24'W, 2004 m, holotype (USNM 148673).

Description.—Holotype complete, 31 mm long and 4 mm wide for about 165 crowded setigers; small paratype incomplete anterior fragment 2.6 mm long and 1.0 mm wide for 22 setigers. Color in alcohol: brown. Anterior end broad, widest between setigers 12–20, dorsoventrally flattened throughout. Body terminating in conical pygidial cone, lacking appendages.

Prostomium bifid anteriorly, formed into two thick rounded lobes or horns, extending posteriorly as short, mounded caruncle, terminating indistinctly at end of first setiger (Fig. 1A). Palps short, thick. Setiger 1 reduced, lacking notosetae, notopodium reduced to single flattened lamella; neuropodium with well-developed pre- and postsetal lamellae and fascicles of capillaries; following segments with well-developed noto- and neuropodia bearing elaborate pre- and postsetal lamellae encompassing setal fascicles (Fig. 1A). Notopodia of middle and posterior setigers with anterior and posterior lamellae, but these lamellae shorter, more triangular and only partly encompassing setae.

Dorsal branchiae present from setiger 2, closely adhering to base of postsetal lamellae (Figs. 1A, 2A); each anterior branchia thickened, extending across dorsal midline; after setiger 20, dorsal branchiae becoming thin, continuing to posterior end. Ventral

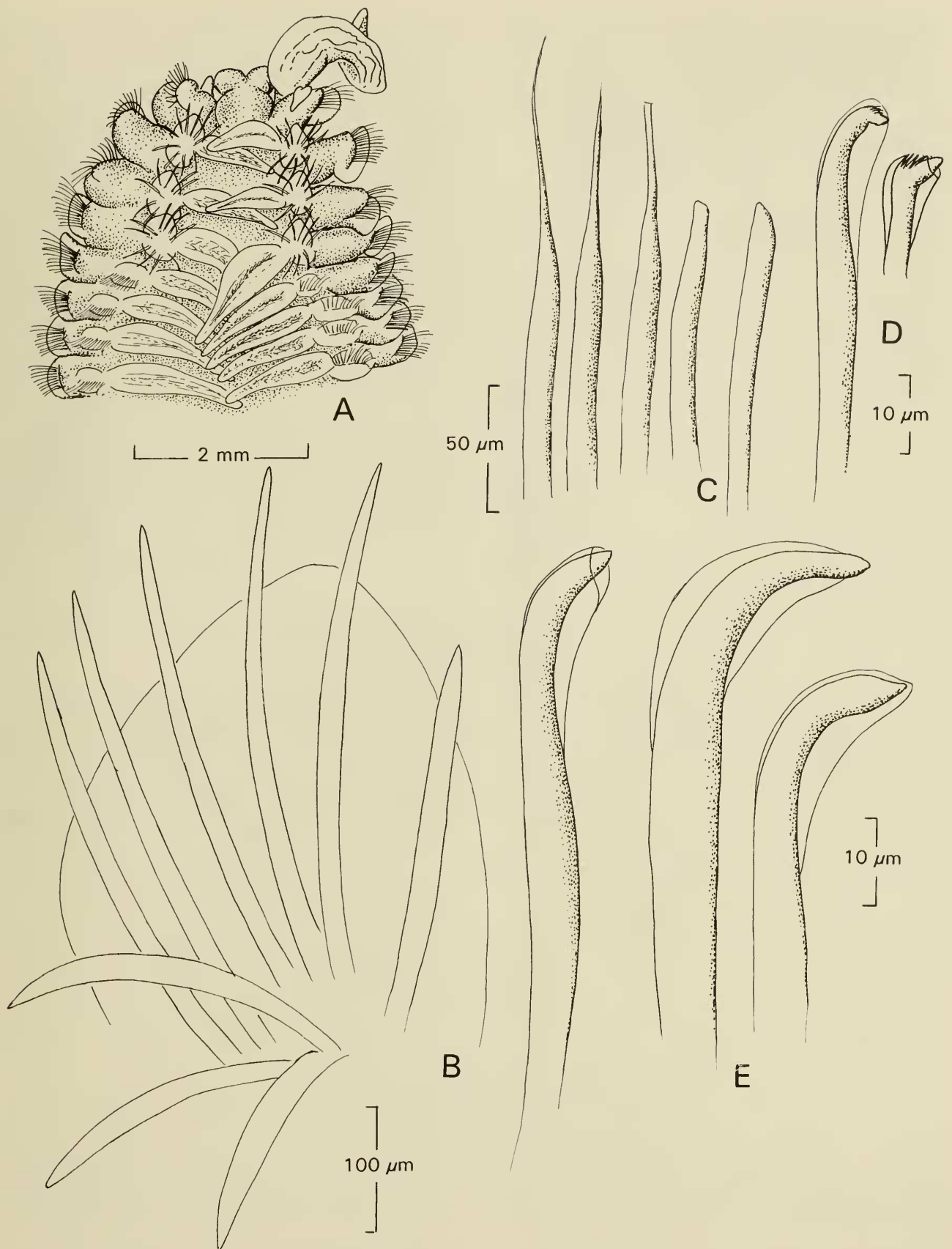


Fig. 1. *Lindaspio dibranchiata* (USNM 148673). A, Anterior end, dorsal view; B, Fascicle of modified notopodial spines from anterior setiger; C, Modified neuropodial spines, unworn and worn; D, Neuropodial hooded hooks; E, Notopodial hooded hooks.

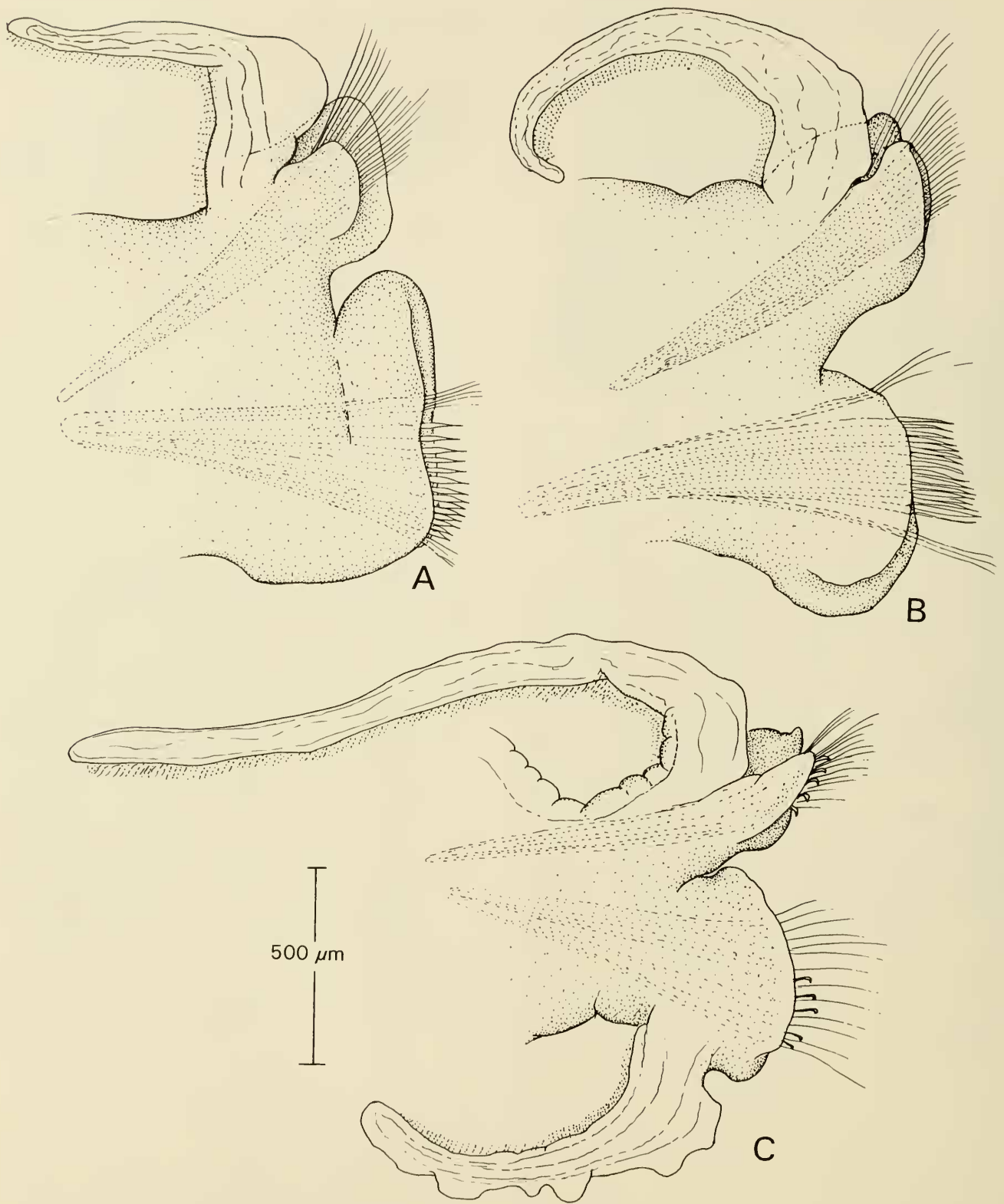


Fig. 2. *Lindaspio dibranchiata* (USNM 148673). A, Anterior parapodium; B, Middle parapodium; C, Posterior parapodium.

branchiae first apparent from about setiger 20 as swollen protuberance of neuropodium (Fig. 2B), becoming well developed by setiger 30 and fully developed by setiger 40 (Fig. 2C); ventral branchiae broader than

dorsal branchiae, not meeting at ventral midline, continuing to posterior end.

Notosetae of setigers 2–4 modified into rosettes of 9–10 heavy spines (Fig. 1A, B); subsequent notosetae consisting of capillar-

ies until about setiger 40 where 3–5 unidentate hooded hooks begin; hooks sharply curved with closely adhering hood (Fig. 1E). Neurosetae of setigers 1–5 all capillaries; with distinct fascicles of 15–20 heavy spines and thin capillaries from setigers 6–28 (Figs. 1C, 2A, B); spines replaced by multidentate hooded hooks by about setiger 45 (Figs. 1D, 2C); neuropodial spines distinctly tapered distally (Fig. 1C), when worn, appearing acicular; neuropodial hooks thinner, more delicate than notopodial hooks (paratype).

Remarks.—See comments under *Lindaspio southwardorum* (below).

Etymology.—The specific name is derived from the Greek, *di* for two or double, and *branchos*, for gill, referring to presence of both dorsal and ventral branchiae that occur on this species.

Lindaspio southwardorum, new species
Fig. 3

Material examined.—Juan de Fuca Ridge, Middle Valley Segment, *Alvin* Dive 2252-3324, 6 Aug 1990, 48°25.8'N, 128°40.9'W, 2425 m, from box core in high-heat-flow area, holotype (USNM 148674); same location and dive, Collection No. A2252-3327, large fragments (JAB).

Description.—A large species, holotype broken into several fragments totaling 341 setigerous segments, 159 mm long, and 6–7 mm wide; anterior fragment with 57 setigerous segments; second, anteriorly incomplete specimen, larger, in two sections, 110 mm long, 8 mm wide. Color in life: pinkish white with pale violet streak down dorsum; color in alcohol: light brown. Anterior half of body dorsoventrally flattened, with dorsum becoming rounded posteriorly. Pygidium not present among fragments.

Prostomium narrow, pear-shaped, flaring anteriorly, forming two broadly swollen lobes, continuing posteriorly as narrow, folded caruncle to anterior margin of setiger 2 (Fig. 3A). Palps short, thick. Setiger 1 reduced, lacking notosetae, neuropodium with

well-developed pre- and postsetal lamellae and fascicles of capillaries, notopodium reduced to flattened lamella. Notopodia of setigers 2–4 modified, dorsally elevated, with pre- and postsetal lamellae forming cup enclosing cluster of modified spines (Fig. 3A); notopodia from setiger 5 and neuropodia from setiger 2 with well-developed, elaborate pre- and postsetal lamellae enclosing setal fascicles (Fig. 3B, C), these continuing in some form through posterior segments; notopodial lamellae eventually becoming more elongate, somewhat triangular (Fig. 3D); neuropodial lamellae remaining broadly rounded throughout.

Dorsal branchiae first present from setiger 2 (Fig. 3A), with those of setigers 2–4 fused basally to modified notopodia, subsequent dorsal branchiae fused to presetal lamellae; anterior dorsal branchia thickened (Fig. 3B), then becoming triangular and thinner posteriorly (Fig. 3C, D); dorsal branchiae relatively short for first 45–50 setigers, never reaching even half of distance to dorsal midline (Fig. 3A), thereafter branchiae becoming thinner, longer, extending to dorsal midline. Ventral branchiae beginning from about setiger 55 as extensions of postsetal lamellae, remaining relatively short (Fig. 3C), until about setiger 100–125, then becoming longer, more cylindrical; in far posterior segments, nearly reaching ventral midline, but never as long as dorsal branchiae (Fig. 3D).

Notosetae of setigers 2–4 modified into cluster of about 20 heavy spines (Fig. 3A); subsequent notosetae numerous, thin capillaries until about setiger 75 where 5–8 hooded hooks appear; capillaries become heavier and more limbate in far posterior segments; individual notopodial hooks strongly curved, with pointed main fang surmounted by several minute teeth (Fig. 3F, G). Anterior neurosetae include row of 25–30 heavy spines, thin companion capillaries, and ventral bundle of thin capillaries (Fig. 3B); neuropodial spines each with smooth shaft that tapers abruptly, then con-

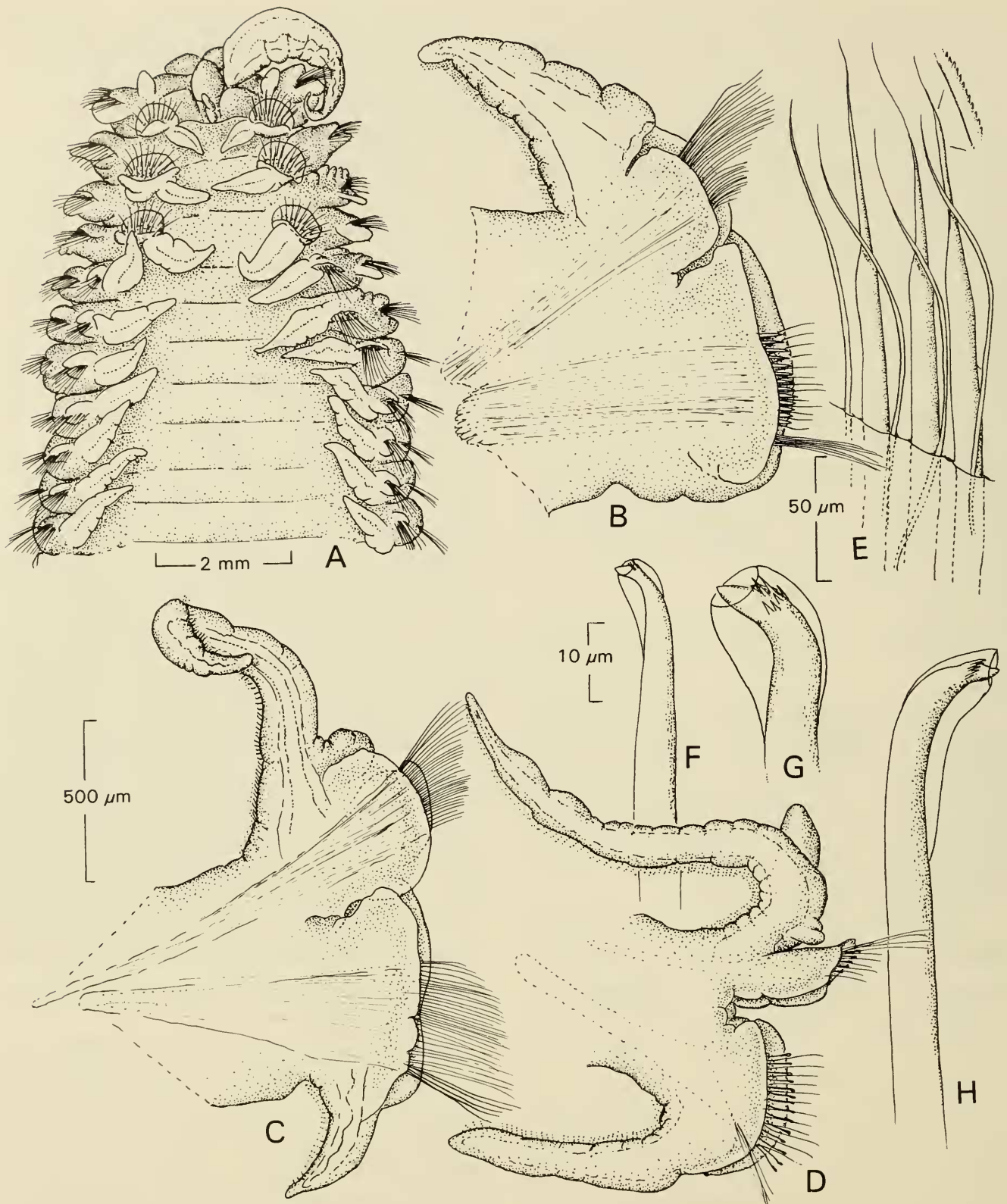


Fig. 3. *Lindaspio southwardorum* (USNM 148674). A, Anterior end, dorsal view; B, Anterior parapodium, anterior view; C, Middle parapodium, anterior view; D, Posterior parapodium, anterior view; E, Modified anterior neurosetae and accompanying capillaries; F-G, notopodial hooded hooks; H, neuropodial hooded hook.

tinues as fine, pointed tip with fine serrations or bristles sometimes visible along edge (Fig. 3E); spines present until about setiger 40, then replaced by thin capillaries; these

capillaries accompanied by delicate neuropodial hooded hooks from about setiger 75 (Fig. 3H); each hook smaller, more delicate than notopodial hook; each hook with sev-

eral minute teeth above main fang. Details of multidentate hooded hooks cannot be resolved by light microscopy.

Etymology.—The specific name honors Drs. Eve C. and Alan J. Southward, deep-sea biologists of the Plymouth Laboratory, United Kingdom. The Southwards participated in the collection of this species and provided field observations.

Remarks.—*Lindaspio dibranchiata* and *L. southwardorum* are the only spionids known to have ventral branchiae and dorsal rosettes or clusters of spines in some anterior notopodia. These characters are considered to be species-level rather than generic characters because of the unusual habitat of these species. A related species described as *Scolecoplepides carunculatus* from off North Carolina has been reexamined and is referred to *Lindaspio*. This latter species lacks ventral branchiae and the dorsal modified spines, but has the same generic-level features including branchiae from setiger 2 and anterior modified neuropodial spines. *L. carunculata* has a distinctive caruncle that is narrow and undulating; *L. southwardorum* has a similar, but smaller caruncle, whereas *L. dibranchiata* has only a short, mound-like caruncle.

Lindaspio carunculata (Maciolek, 1984),
new combination

Fig. 4

Scolecoplepides carunculatus Maciolek, 1984:
58–61, figs. 5–6.

Material examined.—Off North Carolina, U.S. Atlantic Slope and Rise Program, Station 2, 34°14.9'N, 75°43.6'W, 1000 m, 27 Mar 1984, 2 specimens (USNM 148675–148676).

Description.—Large anterior fragment 15 mm long, 2.8 mm wide for 52 setigerous segments; small, nearly complete specimen, 4.6 mm long, 0.7 mm wide for 47 segments. Body very broad anteriorly, with branchiae of anterior segments short, leaving dorsum completely uncovered; posteriorly, body

narrower, branchiae longer, covering much of body surface; individual segments of middle and posterior segments each with distinct medial ciliary band. Color in alcohol: brownish yellow, with branchiae and parapodial lamellae white.

Prostomium button-shaped, prolonged anteriorly into 2 prominent lobes, continuing posteriorly as narrow, undulating caruncle to middle of setiger 2 (Fig. 4A); eyes and occipital tentacle absent. Peristomium reduced, fused with setiger 1; palps short, curved, tapering to narrow tip. Pygidium unknown.

Setiger 1 reduced, lacking notosetae; notopodia limited to thin lamellae thought to be branchiae in original description (Fig. 4A); neuropodia with rounded lamellae and fascicle of capillary setae. Setiger 2 shifted dorsally, following segments normally oriented, with prominent notopodial and neuropodial pre- and postsetal lamellae encompassing fascicles of setae (Fig. 4B). Notopodia of anterior segments with low, rounded presetal lamella and larger, postsetal lamella fused to branchiae; notopodial lamellae becoming thinner, more membranous posteriorly, and separating from branchiae (Fig. 4C, D). Neuropodia of anterior setigers with setae completely enclosed by pre- and postsetal lamellae, with those of anterior segments having low, rounded margins, becoming triangular posteriorly. Branchiae first present from setiger 2; anterior branchiae cirriform, fused for half their length to postsetal notopodial lamellae; branchiae of middle and posterior segments larger, thin, lamellate, free from notopodial lamellae, or fused only at base, each ciliated along inner border, merging with dorsal, transverse ciliary band.

Notosetae of anterior and middle segments all smooth capillaries, arranged in 3–4 rows with longest setae in superior bundle; notopodial hooded hooks first present from setiger 42 (21 in small specimen); each hook very narrow, with curved tip and no apparent apical teeth above main fang (Fig.

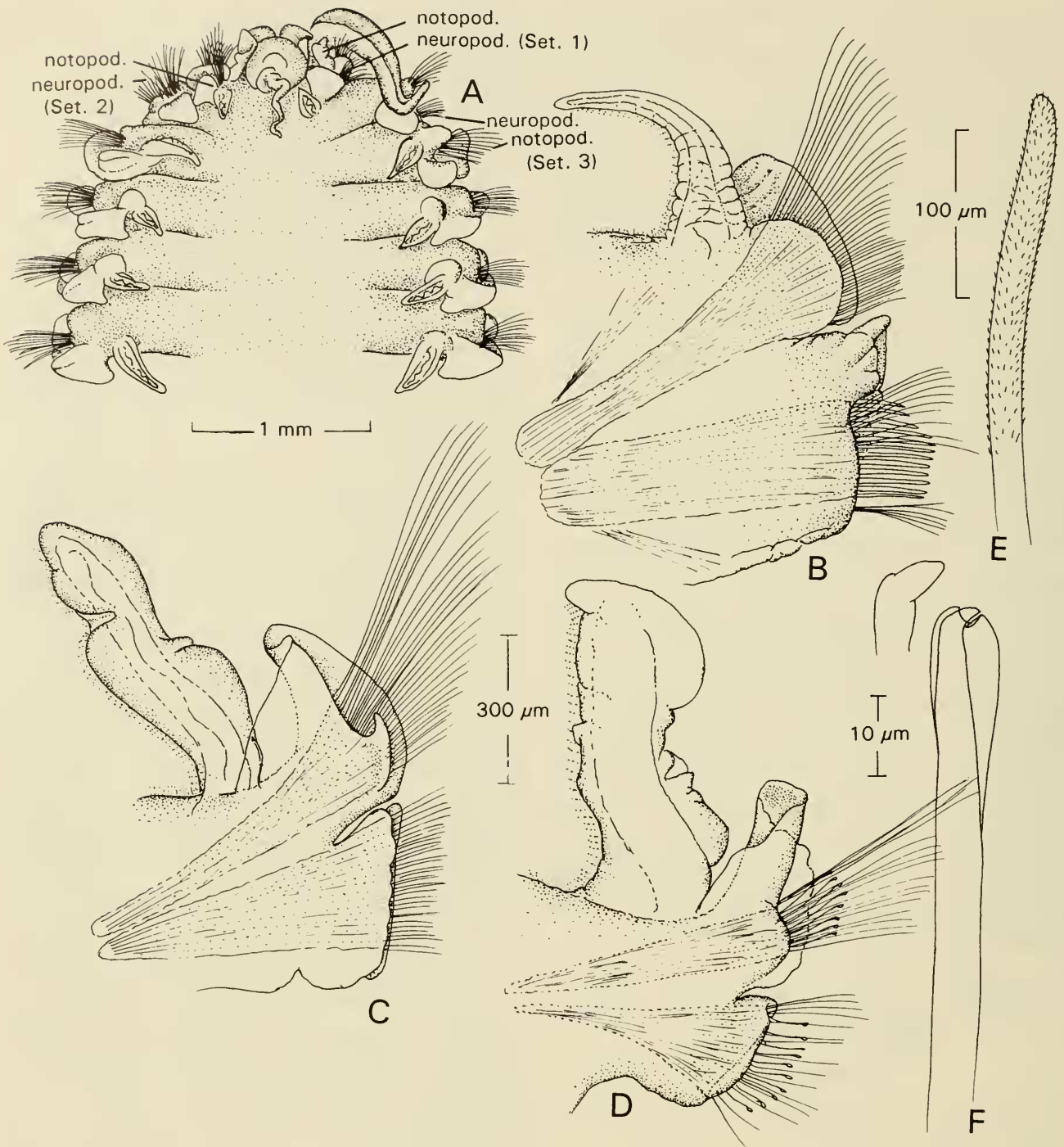


Fig. 4. *Lindaspio carunculata* (USNM 148675). A, Anterior end, dorsal view; B, Anterior parapodium, anterior view; C, Middle parapodium, anterior view; D, Posterior parapodium, anterior view; E, Modified anterior neuroseta; F, Neuropodial hooded hook. Abbreviations: notopod. (=notopodium); neuropod. (=neuropodium); Set. (=setiger).

4F); hooks numbering about 15 in fascicle, accompanied by numerous thin capillaries. Neuropodia of setigers 1–2 with dense fascicles of capillaries, partially replaced by heavy modified hirsute spines from setiger 3 (Fig. 4E), continuing until about setiger 12, then spines becoming thinner, and replaced entirely by capillaries again from se-

tiger 15; spines blunted when worn (Fig. 4E); pointed when unworn (Maciolek, 1984: fig. 6C); neuropodial hooded hooks first present from about setiger 29 (10 in small specimen); hooks of same structure as notopodial hooks, numbering about 11 per fascicle with 20 or more accompanying capillaries.

Remarks.—This redescription of *Lindaspio carunculata* elucidates the structure and distribution of the hooded hooks and presents a reinterpretation of the nature of the first setiger. In the original account, the neuropodia were said to be lacking, with only notopodia and small branchiae present (Maciolek 1984). It is now clear that the structures thought to be branchiae are actually notopodial lamellae situated adjacent to the dorsally placed neuropodia. Branchiae actually begin on setiger 2. With this interpretation, the species does not agree with the definition of *Scolecopides* in which branchiae begin on setiger 1. Hooded hooks were lacking in all of the specimens on which the original description was based (Maciolek 1984). With the information presented here about the structure of the hooded hooks, the nature of the prostomium and caruncle, and the reduced nature of setiger 1, it is apparent that *S. carunculatus* is closely related to the two new deep-sea hydrothermal vent species assigned to the new genus *Lindaspio*. On this basis, *S. carunculatus* is herein referred to *Lindaspio*, despite the lack of ventral branchiae and modified anterior notosetae. These characters, while unique in the Spionidae, are considered to be species-level rather than generic characters.

Discussion

Two related genera, *Marenzelleria* Mesnil and *Scolecopides* Ehlers, were revised by Maciolek (1984). The new genus, *Lindaspio*, represents a deep-sea companion to the shallow water *Scolecopides*. A unifying feature of these two genera is the presence of ventral acicular spines in some anterior setigers. A distinguishing feature that separates these genera is the presence of branchiae on setiger 1 in *Scolecopides* and setiger 2 in *Lindaspio*.

The three species of *Lindaspio* described in the present paper represent two species groups. The first, represented by *L. carunculata*, is the least modified and is found in

ambient soft-bottom sediments on the continental slope off North Carolina. The second group, represented by *L. dibranchiata* and *L. southwardorum*, comes from sediments associated with active hydrothermal vents in the eastern Pacific. The presence of anterior notopodial spines and ventral branchiae is highly diagnostic and unique among spionids. It is likely that the branchiae are an adaptation that provides an increased respiratory surface in a low-oxygen environment. The function of the anterior spines is not known. The close relationship between the less modified *L. carunculata* and the two vent species is seen in the structure of the prostomium and the caruncle. All three species have well-developed frontal lobes or horns. The narrow, undulating caruncle of *L. carunculata* was noted by Maciolek (1984) to be an unusual character that was more reminiscent of amphinomid. The presence of a similar caruncle in one of the vent species, *L. southwardorum*, and similar prostomia in all three species, is evidence of their close relationship.

Lindaspio southwardorum at a length of 15+ cm and a width of 7 mm is one of the largest and most robust spionids ever reported. The presence of fragments of an even larger specimen indicate that this species can reach proportions that are gigantic for a spionid.

Acknowledgments

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